List of U.S. Army Research Institute Research and Technical Publications

October 1, 1994, to September 30, 1995

With Author and Subject Index

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United States Army Research Institute for the Behavioral and Social Sciences

1996

U.S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency Under the Jurisdiction
of the Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Director

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The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is the Army's primary manpower, personnel, and training research and development agency. This document presents and annotated list for FY95 of research and technical publications.

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Foreword

The means of dissemination of the results of ARI's research and development/studies and analysis program vary widely depending on the type of work, the subject matter, and the sponsor/proponent. Typically, major findings with immediate policy and procedural implications are briefed to sponsors and proponents in order to enable timely implementation. This is followed up with complete documentation in the form of research and technical publications such as the ones listed here. In many cases, these documents represent the actual item handed off to the sponsor/proponent; this is particularly true of the Research Product category. In other cases, results are published in order to provide a complete record of the work done, and for future reference by researchers doing work in the same or similar areas.

This annotated list for FY95 provides an idea of both the depth and scope of the ARI research effort, and is a valuable resource for anyone interested in military psychology from either a scientific or operational perspective.

ZITA M. SIMUTIS
Deputy Director
(Science and Technology)

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Director

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Introduction

The primary responsibility of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is to maximize soldier effectiveness. ARI accomplishes its mission through research and development in the acquisition, training, utilization, and retention of Army personnel. ARI research and products affect every Army mission with a human performance component.

As convenient references for qualified agencies and individuals and sponsors, ARI publishes lists of its technical and research publications. This issue of the publication list describes reports published during the period October 1, 1994, to September 30, 1995. It contains the abstract of each publication and the bibliographic information needed to identify a publication. The abstracts have been written, as far as possible, to describe the principal research findings in nontechnical terms; however, technical language is used to communicate efficiently the details of research analysis. Author and subject indexing provides access to individual reports and topics.

This publication supplements the 44-year list of ARI publications issued from October 1, 1940, to September 30, 1983; the list of publication abstracts issued annually from October 1, 1958, to September 30, 1983; the list of publications issued from October 1, 1980, to September 30, 1986; the list of

publications issued from January 1, 1986, to September 30, 1989; and the list of publications issued from October 1, 1989, to September 30, 1994.

ARI Publications

ARI publications are divided into separate, consecutively numbered categories appropriate to their intended audience and function. During fiscal year 1995, the following types of research and technical reports were issued by ARI:

Research Note (RN). An interim or final report typically of limited interest outside of ARI. It is filed with the Defense Technical Information Center (DTIC) but is not printed. Research Notes usually fall into one of the following categories:

- An inhouse report that is of limited interest outside of ARI but is considered worth submitting to DTIC to be part of the Department of Defense (DoD) archive of technical documentation.
- An interim contract report that is of limited interest outside of ARI but is considered worth submitting to DTIC to be part of the DoD archive of technical documentation.
- A final contract report that is of limited interest outside of ARI but must be submitted to DTIC in accordance with Department of the Army regulations to close a contract.

- Material related to a Research Report or Technical Report (detailed tables, graphs, charts, sample forms, and sample training and testing materials) published as a Research Note to economize on printing and distribution.

Research Product (RP). A user-oriented report intended to aid Army personnel. Examples are handbooks, manuals, and guidebooks.

Research Report (RR). A report of completed research intended primarily for dissemination to military managers. Research Reports may deal with policy-related issues but typically do not include specific policy recommendations.

Study Note (SN). A Study Note may contain or consist of technical text, computer code, diskettes or tapes with software, databases, codebooks or other documentation, raw data, data collection instruments, figures, tables, or any other products that do not concisely convey the import of a project but which must be archived for technical completeness.

Study Report (SR). A published report briefly documenting studies and analyses.

Technical Report (TR). A report of completed research intended primarily for dissemination to researchers.

Research Reports and Technical Reports published by the U.S. Army Research Institute for the Behavioral and Social Sciences are intended for sponsors of research and development (R&D) tasks and for other research and military agencies. Any findings ready for implementation at the time of publication are presented in the last part of the Executive Summary. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or memorandum.

ARI Distribution

Initial distribution of these publications was made directly by ARI. Research Reports, Technical Reports, Study Reports, and Research Products were distributed primarily to operational and research facilities and their sponsors in DoD, to other interested Government agencies, and to DTIC; copies of some reports were also sent to the Library of Congress for distribution to libraries participating in the Documents Expediting Project. Research Notes and Study Notes were deposited with DTIC but were not published.

These publications are **NOT** available from ARI. DoD agencies and contractors can purchase paper copies or microfiche from—

Defense Logistics Agency
Defense Technical Information Center
8725 John J. Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218
(703) 767-9030 or DSN 284–9030

Other Government agencies and the general public can obtain unclassified reports from—

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487–4650

NOTE: *When requesting copies of these reports, use the DTIC accession number (AD _ _ _ _ _ _ _) appearing in parentheses following the date of publication of each citation.*

Research Notes

RN 95-01 The content, construct and criterion-related validity of leader behavior measures, Atwater, L.; Lau, A.; Bass, B.; Avolio, B.; Camobreco, J.; Whitmore, N. October 1994. (AD A290 124) This report is the second in a series on methods and results of a longitudinal study of leadership and its development on a sample of candidate officers presently enrolled in a military college. Included in the report are results from the first set of comprehensive assessments, which examined the content, construct, and criterion-related validity of leadership measures. Data were collected using a multi-source/multi-method approach from the entering class of 1991 at Virginia Military Institute. Methods of data collection included interviews, structured observations, surveys of management and leadership behaviors, and leadership logs (critical incidents). Sources of leadership information included superiors, peers, self, and subordinates. Convergence across both methods and sources on the leadership behaviors displayed by subjects was found. Data on leadership thus far collected provide a reliable and valid baseline for future research, and support the content, construct, and criterion-related validity of the leadership measures used.

RN 95-02 Advanced team decision making: A model and training implications, Zsambok, C.E. October 1994. (AD A289 855) In this research, our primary goal was to develop a theory-based training program that would enable U.S. Army Officers to achieve more effective strategic team decision making. Commensurate with Small Business Innovation Research program aims, our secondary goal was to commercialize this project beyond the testbed domain. We were successful in achieving both goals. First, we produced a model of Advanced Team Decision Making (ATDM) and an accompanying training program that has been embedded in the strategic decision-making curriculum of the Industrial College of the Armed Forces. Results of a formative study lend positive support to (a) the validity of core concepts of the ATDM model; (b) the relation of the model to common constructs in the current teamwork literature; (c) the conclusion that trainees improve their ability to discriminate good versus poor decision-making behaviors when given guided practice with the model; and (d) the conclusion that trainees improve their awareness of the link between their team product's quality and their ability to engage in ATDM behaviors. Second, we have commercialized the program within a new domain that extends the model's applicability from strategic planning and decision making with ad hoc teams to tactical planning and decision making with both ad hoc and intact teams.

RN 95-03 Training metacognitive skills for problem solving, Geiwitz, J. November 1994. (AD A290 310) Metacognitive skills that involve monitoring and control of cognitive skills like problem solving develop in expert executives and lead to great improvement in the problem-solving process. In this report, we review theory and research on metacognition to construct a conceptual model that has three characteristics: (1) it shows the interrelationship of metacognitive skills and cognitive task performances, (2) it suggests the most valid assessment techniques for the measurement of metacognitive skills, and (3) it shows the development of metacognitive skills. From the third characteristic, we designed a training program to ac-

celerate the acquisition of metacognitive skills in officers in the U.S. Armed Forces. From the second characteristic, we will construct proficiency tests of metacognitive skills for measuring these skills in commanders at various levels of professional development; the tests will also be used to evaluate the effectiveness of the training.

RN 95-04 An investigation of coping and adaptation in USAREUR: Criteria of adaptation, life role demands faced by first term enlistees, and services provided by USAREUR agencies, Dawson, R.; McGuire, W.J.; Brooks, M.K.; Hebein, J.M. November 1994. (AD A291 532) This research is part of the Life Coping Skills in USAREUR Project that was initiated to investigate the assumption that there is a relationship between a first-term enlistee's ability to function both on and off the job and the extent to which soldiers adapt to new environments. Adaptation is important because research suggests that success in this area affects mission readiness. The report addresses three questions: what indicators differentiate between soldiers who have and those who have not adapted to new environments?, what life role demands are commonly faced by first-term enlistees?, and what services provided by the U.S. Army in Europe are available to help first-term enlistees cope with everyday life? Major life coping areas explored include health, legal, leisure, work, education, and consumer/financial. To gather this information, first-term enlistees, first-line supervisors, and representatives of military agencies were surveyed and interviewed. Results of interviews were used to determine priorities for subsequent activities, especially in curriculum, instruction/training, and assessment efforts.

RN 95-05 Life coping skills in USAREUR pilot program, Dawson, R.; Hebein, J.; Maddox, C.; Kerr, M.; Brooks, K.; Fullard, M. November 1994. (AD A289 936) The *Doing It in Deutschland* programs were developed to teach first-term enlisted soldiers in USAREUR the knowledge and skills needed to (1) use public transportation in Germany, (2) eat out on the economy, (3) use USAREUR community resources, (4) shop in German stores, and (5) understand the legal aspects of living in Germany. The programs are competency-based, multi-media programs that utilize two delivery systems: first, a mass media approach with AFN radio and Stars and Stripes newspaper and, second, Army education centers. The programs were tested and formatively evaluated in controlled settings. The findings in this report subsequently served as the database for decisions regarding modifications for program revisions.

RN 95-06 Coping and adaptation: Theoretical and applied perspectives, Dawson, R.; Sharon, B.; Brooks, K.; McGuire, W. November 1994. (AD A290 513) Soldiers who have limited skills and affective attributes from which to draw to cope with the barrage of requirements from assignment in Germany are less likely to adapt successfully to that environment. At the level of the individual soldier, actions could be taken to assist in acquisition of vital life coping skills that, in turn, would facilitate successful adaptation to life in Europe and reduce problems with retention and performance. This report describes the theoretical framework for the Life Coping Skills in USAREUR project, develops a model of the coping process, summarizes studies that have identified needed life coping skills, reviews literature related to adaptation to the military and to foreign coun-

tries, and makes recommendations concerning directions and procedures for project tasks.

RN 95-07 Measuring the costs and benefits of Army service, SAG Corporation. November 1994. (AD A289 935)

This research puts the costs and benefits of Army service into a social accounting framework. The traditional budget cost and defense readiness perspective is expanded to account for joint product effects of Army service. The analysis concentrates on Army personnel and training programs, noting that the value of military experience and training in the civilian sector is a major area in which the social value of Army service is likely to exceed the private value. The social value of certain forms of unit training and exercises is scrutinized to detect potential structural changes that yield additional social benefits. The analytical framework developed helps the Army to better understand the true social costs and benefits of its personnel and training programs; to choose ways of achieving a given level of military readiness that produces the greatest net social value; to articulate to Congress the social value, in addition to the military readiness value, of some of its programs, thus producing more informed decisions concerning defense and non-defense uses of taxpayer resources; and to explain to potential recruits and to the taxpayer the value of some Army programs to other sectors of the economy.

RN 95-08 Macroprocesses and adaptive instruction, Tobias, S. November 1994. (AD A290 483)

A paradigm for the unobtrusive monitoring of students' cognitive processing of instruction (macroprocessing) by microcomputer was developed for this project. The paradigm was used in four experiments that examined the types of processing students use during their reading of expository texts. The results indicated that students' voluntary use of macroprocesses and review was highly variable and ineffective. However, when the instructional system prescribed or prompted use of review if there was evidence of poor comprehension, or when an explanation of the value of review was provided, learning generally improved, especially for students with limited prior knowledge of the content. The implications of these results for further research are discussed. The findings also suggest that the paradigm can be used to deliver cost-effective instruction to improve students' cognitive processing of reading and ultimately their comprehension. This project solved some of the programming, procedural, and technical problems encountered in developing a computer-based delivery system for such instruction.

RN 95-09 A life course analysis of the military service of 1966 graduates of an eastern university. Journal of Political and Military Sociology 1995, Vol. 23 (summer): 65-79, Frieze, I.H.; Grote, N.K.; Bookwala, J.; Capps, W.; Schmidt, L. November 1994. (AD B196 249L)

A group of Princeton alumni, all who had graduated from college in 1966, were studied to determine the long-term effects of military service in this elite group. The total group of 378 was subdivided into those who had served in Vietnam (n=52), those who had served in the military in some other location (n=77), and those who did not serve in the military (n=249). Overall, all groups saw the Vietnam war as having a major impact on their lives. Three separate studies were done using data from this sample. In the first, it was found that the Vietnam veterans did have evidence of long-term debilitating effects of service. The second study analyzed changes in political at-

titudes. The Vietnam veterans were found to hold the most politically conservative attitudes both before and after the war. All groups became more supportive of military action between 1966 and 1991. In the third study, the effects of social support on physical and mental health at midlife were assessed for the groups. For all groups, reliance on the self was associated with lower health outcomes. Marital support was highly important for mental health.

RN 95-10 Developing automatic components for complex tasks,

Schneider, W. November 1994. (AD B196 539) This report reviews the program of research to understand the nature of automatic process development and its role in building skilled performance in troubleshooting and high workload domains. The contributions can be divided into three major themes. The first theme involves modeling skill acquisition and performance in high workload tasks. The second investigates the buildup of component fluency in problem-solving tasks, including troubleshooting and algebraic tasks. The third involves reports about the computer methods that have been developed as we produced tools to enable the modeling and empirical data collection work to proceed. Abstracts of 21 papers are included. The major contributions include review of the working memory literature; development of controlled/connectionist models of working memory and high workload performance; interpreted changes in high workload performance; examined acquisition of electronic troubleshooting gate knowledge; empirically tested transfer from component learning to troubleshooting contexts, the role of practice in working memory and how changes in sequences of processing (reloading and executing a production) enhance learning. Five

guidelines for developing automatic component skills are discussed. Models of working memory, high workload learning, and declarative learning are discussed. Efforts to enhance development of computerized research are listed.

RN 95-11 A study of cohesion and other factors of major influence on soldiers and unit effectiveness,

Yagil, D. January 1995. (AD A299 079) The present research focuses on the issue of small unit cohesion based on organizational bonding, horizontal bonding, and vertical bonding in relation to unit effectiveness. The study analyzes the intervening effects of professionalism confidence in the commander, commander tenure, morale, motivation, and stress on the relationship between cohesion and effectiveness. A questionnaire set composed of the ARI "platoon cohesion index," and the IDF Questionnaire was administered to 1 8 infantry platoon and 7 armor companies. Higher Commanders of the units evaluated the units with regard to the research variables. The results indicate significant correlations between cohesion and unit effectiveness. Differences were found in the relationship of the cohesion dimensions to effectiveness to other variables. The results also revealed differences between soldiers and commanders in their perception of the relationship between cohesion and personal effectiveness. Morale and stress were found to be intervening variables, effecting the relationship between cohesion and effectiveness. The implications of the results to unit processes and further research directions are discussed.

RN 95-12 Optimal averaging in performance testing,

Jones, M.B. January 1995. (AD A298 836) The purpose of this research was to develop a methodology

for optimizing the temporal stability and predictive validity of performance tests and to apply that methodology to the Project-A, computer-administered tests. In the present research, a performance test is treated as a task to be practiced, and tests are analyzed as individual differences in skill acquisitions and retention. Classical test theory is also used. The predictive validity of the Project-A, computer-administered tests for a simulated anti-aircraft criterion task was studied over a 4-month interval in a sample of 102 college students; the 4-month temporal stability of the tests was studied concurrently in the same sample. Three of the 10 Project-A tests (Choice Reaction, Target Tracking 2, and Cannon Shoot) show a forward stability optimum. Cannon Shoot also has high predictive validity (.59). It could have the highest predictive validity of any test in the Project-A battery if its temporal stability could be improved. In none of these tests, however, can temporal stability be improved by lengthening the tests.

RN 95-13 Level and type of capability in relation to executive organization, Jaques, E.; Stamp, G. January 1995. (AD A298 621) The specific objective of this report is to test earlier work on the assessment of individual capability to perform in real life with reference to the capability to carry responsibility at higher levels of work in both civilian and military organizational settings. In relation to this objective, this report increases scientific understanding of the meaning of human capability in action and of the nature of the psychological processes underlying the level of complexity of action the person can generate, comprehend, and effect; the type of capability they prefer to use; and the growth of capability to act and take responsibility at increasingly complex levels. In

this work, the implications of Stratified Systems Theory are examined and applied to military organizational settings.

RN 95-14 The effects of stress on judgement and decision making: An overview and arguments for a new approach, Hammond, K. January 1995. (AD A298 615) This monograph consists of an overview of four principal literatures on the effects of stress on human performance, with specific reference to studies of the effects of stress on human judgement and decision making. The four literatures are: Clinical/social/personality (Literature I), ergonomics/human factors (Literature II), psychophysiology (Literature III), and judgement and decision making (Literature IV). The overview led to the following conclusion: Literature I through III are independent and isolated from one another (with the exception of some connections between Literature II and III; they contain essentially no material from Literature IV, which in turn includes essentially none of the material. In deed, there is hardly any work directly related to the effects of stress on judgement and decision making. Thus, there are no secure generalizations regarding these effects. Following the presentation of material that supports these conclusions, I first review the current theories of the effects of stress on judgement and decision making, broadly conceived, from Literature I and III. (Since 1970, roughly 17 theoretically oriented articles have appeared in Literature I and II. Second, I provide brief comments on 10 reviews of the topic. (Ten of the 17 theoretical articles also provided general reviews.) Third, I briefly describe the numerous and varied conditions and operations that have been used to induce stress in empirical studies. Roughly 13 different conditions have been employed as stressors.) Fourth, the psychological/behavioral

functions examined under the aforementioned conditions are described. (I organize the various dependent measures that have been employed into eight categories.) Fifth, empirical studies of specific stressors and psychological/behavioral functions are cross-specific stressors and psychological/behavioral functions are cross-tabulated. (A table linking the 13 stressors and the 8 categories of psychological/behavioral functions examined enables the reader to ascertain rapidly which stressors have been studied in relation to which psychological/behavioral functions.) Sixth, the implication of the results are discussed and the status of our knowledge is appraised. (The table alone makes it obvious that our knowledge is scanty, and unevenly distributed over stressors and psychological/behavioral functions.) Finally, in work to be carried out in 1991, I offer a new conceptual framework, address certain methodological issues, and make a recommendation for future research on the effects of stress on judgment and decision making.

RN 95-15 Causal models in the acquisition and instruction of programming skills, Reiser, B. January 1995. (ADA 293 438) This research project investigates how an interactive learning environment can support students' learning and acquisition of mental models when acquiring a target cognitive skill. In this project, we have constructed GIL, an intelligent tutoring system for LISP programming, and have used GIL to conduct pedagogical experiments on skill acquisition. We have studied two ways in which an interactive learning environment can facilitate students' acquisition of novel complex domains. The first set of studies examines how explanatory feedback, generated from the system's problem-solving knowledge, can facilitate students' learning.

The experiments demonstrate computer-based support during learning can help students construct a more effective model for reasoning in complex domains.

RN 95-16 Optimizing the long-term retention of skills: Structural and analytic approaches to skill maintenance, Healy, A.F. January 1995. (AD A293 438) Progress has been made in determining guidelines for optimizing the long-term retention of skills. Studies on learning and retention of color-word interference, schedule components, list components, mental arithmetic, and vocabulary acquisition suggest that optimal retention will result from using procedures during training, relating information to previous experience, making the information distinctive, promoting direct retrieval of the information, and providing refresher or practice tests.

RN 95-17 People misinterpret conditional probabilities, Hamm, R. January 1995. (AD A293 527) This final report summarizes the results of the project "The Use of Protocol Analysis and Process Tracing Techniques to Investigate Probabilistic Inference." In probabilistic inference, people use uncertain information to change uncertain beliefs, That is, they must integrate base rate information (about what usually happens) with uncertain information about what is happening in the present. The research shows that the most recently presented information is given undue attention. Further, although subjects recognize that the base rate information in probabilistic inference word problems is relevant, they do not give it enough impact in their considerations. This is not because of their tendency to use available numerical expressions of probability as their response, but because of their

inability to interpret conditional probabilities appropriately. Specifically, the subjects think that the conditional probability p (evidence/hypothesis), which is given in the word problems and what should be taken as an input to Bayes' Theorem, is p (hypothesis/evidence), which is the output of Bayes' Theorem and which is the answer that they are asked to produce. This mistake causes subjects to produce answers that are independent of base rate information.

RN 95-18 Technical and analytical support for the U.S. Army Research Institute, Ruskin, R.S. January 1995. (AD A296 956) The objective of this contract was to provide technical and analytical support for the conduct of U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) inhouse research. Area universities, through their membership in the Consortium of Universities, contributed to a wide variety of research projects and provided various technical and analytical support services. The majority of the support services were provided by Consortium Research Fellows (CRFs), graduate students in the social sciences employed by the Consortium to act as research assistants to the scientists at ARI. Other services provided included sharing the Consortium's faculty expertise database, which allows ARI to search on-line and identify persons with particular expertise, experience, or capabilities necessary to provide assistance on a given research task. ARI was given access to faculty expertise and laboratory facilities at Consortium institutions to cooperate in research projects directed by ARI scientists, and Senior Consortium Research Fellows (SCRFs) provided assistance to ARI. The impact of the Consortium's assistance to ARI has been felt in the increased number of CRFs and SCRFs over the 3-year period, in

the increased number of scientific disciplines represented by CRFs over the 3-year period, in the total number of hours worked by Consortium personnel, in the number of ARI scientists who have acted as "mentors" to CRFs, in the number and quality of research publications resulting from professional relationships between contract personnel and ARI scientists, in the use of Consortium personnel for field research, and in the number and variety of outreach activities associated with the contract.

RN 95-19 Cognitive resource theory and the utilization of the leaders' and group members' technical competence, Murphy, S.E.; Blyth, D.; Fiedler, F.E. January 1995. (AD A296 671) The belief that training leads to improved job performance is often unquestioned. For various reasons, however, research has failed to demonstrate a consistent relationship. Two related experiments investigated the conditions under which technical training for leaders and group members contribute to group performance. The first study compared the effectiveness of decisions in groups in which the leader was (a) instructed to be either directive or nondirective, and (b) given a brief training period to provide task-relevant knowledge for making the required group decisions. A second study compared the performance of trained group members under directive and nondirective leaders. As hypothesized, the leader's technical knowledge or expertise contributed to group performance only if the leader was both trained and directive; group members' task-relevant knowledge contributed to group performance only if the leader was nondirective. The results are discussed in the context of Cognitive Resource Theory.

RN 95-20 Psychological approaches to organized agression: 2nd final report, Rachman, S. January 1995. (AD A296 671) The purpose of this paper was to consider whether psychologists are in a position to improve our understanding of and ability to deal with terrorism and its effects. The psychological aspects of terrorism are divided into six categories. The six categories of psychological terrorism are (1) psychological analyses of the terrorist; (2) the nature, timing, and effects of terrorist acts; (3) the behavior during acts of terrorism of terrorists, victims, and negotiators; (4) the prediction and prevention of acts of terrorism; (5) the effects of such acts on victims; and (6) psychological assistance for victims.

RN 95-21 Development of courage in military personnel in training and performance in combat situations, Rachman, S. January 1995. (AD A296 369) The objective of this study was to investigate the components of courage, to study the development of courage through training to performance, and to identify the distinctive qualities, if any, of courageous people. The study was directed toward the selection, training, performance, and post-tour adjustment of bomb-disposal operators of the Royal Army Ordnance Corps (RAOC).

RN 95-22 Recruitment, retention, wastage and retirement: Career patterns in the officer corps of the British armed services 1970-82, Bellany, I. February 1995. (AD A296 252) A policymaking tool has been fashioned for those concerned with officer recruitment and promotion policy. The tool is basically a transition matrix with elements that consist of the probabilities in any one year that (a) a civilian will join the officer corps, or (b) a cap-

tain will be promoted to major, or (c) a major will exit the service for civilian life, and so forth. The size of the matrix at its fullest is determined by the number of discrete ranks plus the civilian status—say eleven. The number of elements within it would be 121 (11 x 11), although the value of many of these will be zero, corresponding to the near impossibility in normal times of promotion through more than one rank at a time.

RN 95-23 Examining the effect of information sequence, Adelman, L.; Bresnick, T.A. February 1995. (AD A296 530) This paper describes a recent experiment conducted with Patriot air defense officers and using the Patriot air defense simulators at Fort Bliss, Texas. The experimenters found that, under certain conditions, the participants made different identification judgments and took different engagement actions depending on the sequence in which the same information was presented to them. This finding was consistent with theoretical predictions regarding how operators process information, and the hypothesis that their processing approach (or Heuristic) would result in biased judgments under certain conditions. Future research is directed toward investigating whether display modification can remove the observed judgmental bias. Generally, this experiment demonstrates the applied implications of basic research investigation human information processing, and the importance of understanding cognitive processes when developing computer systems.

RN 95-24 A cognitive architecture for solving ill-defined problems, Holyoak, K.J.; Thagard, P.R. February 1995. (AD A293 582) A computational theory of analogical mapping is described, based on a small set of constraints. The theory is

embodied in a computer simulation that is applied to several examples, including psychological data on the mapping process.

RN 95-25 to 95-26 Canceled.

**RN 95-27 Reducing the confirmation
                bias in an evolving situation,**
Tolcott, M.A.; Marvin, F.F. February 1995.
(AD A293 570) This report presents the results of Phase 2 research on decision making in an evolving situation. As in Phase 1, the problem context was situation assessment by trained Army intelligence analysts working in pairs. Participants were given an initial battlefield scenario and asked to determine the enemy's most likely avenue of approach and to give their level of confidence; subsequently they were asked to reconsider their decisions after receiving each of three updated intelligence reports that contained some items that confirmed and some that did not confirm their early hypothesis. Finally, the participants were asked to rate each information item in terms of the degree to which it supported or contradicted their hypotheses.

**RN 95-28 Integrating analogies with
                rules and explanations,** Nelson,
G.; Thagrad, P.; Hardy, S. June 1995. (AD
A297 315) This paper presents a new integrated artificial-intelligence model, Connecting Analogies With Rules and Explanations (CARE), which combines analogy, rule use, and the assessment of explanatory coherence. The model is applied to complex problem-solving and decision-making tasks in a variety of domains.

RN 95-29 Canceled.

**RN 95-30 Ultradian rhythms in pro-
                longed human performance,**
Lavie, P.; Zomer, J.; Gopher, D. February 1995. (AD A296 199) This study investigates (1) the occurrence of approximately 14.4 cycles/day ultradian rhythms in the ability to fall asleep during morning and afternoon hours, (2) the phase relationship between these rhythms and the REM-NON-REM sleep state rhythms, and (3) the phase relationship between the sleepiness rhythms and ultradian rhythms in perceptual motor performance. Eight healthy males ages 24+2 with normal sleep-wake habits were tested. Each subject, after an adaptation night, spent two 24-hour periods in the laboratory. Subjects began at 1600 a strict 5:15 min sleep-wake schedule that lasted for 8 hours (1600-2400). During each of the 24 5-min sleep attempts, polysomnographic recordings were done and during the 15-min scheduled wake time psychomotor testings were conducted. At 2400 subjects retired for an uninterrupted nocturnal sleep with polysomnographic recordings. Subjects were awakened after 6-7 hours of sleep and a second 3-hour period of the same schedule was initiated. Awakening from nocturnal sleep was timed by the experimenter either from REM sleep (first 24-hr experimental period) or about 25 min after the end of a REM period (second experimental period) for 4 subjects, and the reverse order for the other 4 subjects. Although the average percentages were similar, spectral analysis revealed a different temporal structure of stages 1 and 2. Distributions were bimodal with peaks around 1630 and 2300. The morning distributions were much more episodic, resembling the 90-min ultradian rhythmicity reported by Lavie and Scheron (1981). These results suggest that, despite the impressive stability of the morning and evening (accumulated) sleep, the ultradian rhythmicity in sleepiness is nonstationary and is modulated by a cir-

cadian cycle. Ultradian rhythms of similar frequency were found in perceptual and motor performance. The rhythms in perception, however, were drastically modified by altering the sampling frequency and were, therefore, attributed to statistical artifact. The rhythms in motor performance, on the other hand, persisted under both sampling frequencies and can therefore be considered a true endogenous rhythmicity. The analysis of the phase relationship between the rhythms in motor performance and physiological indexes of arousal is being performed in our laboratory.

RN 95-31 The relation between group cohesiveness and performance: An integration, Mullen, B.; Cooper, C. February 1995. (AD A296 297) This paper reports on a meta-analytic integration of the relation between group cohesiveness and performance. Overall, the cohesiveness-performance effect was highly significant and of small magnitude. Several theoretically informative determinants of the cohesiveness-performance effect were examined. This effect was significantly stronger when cohesiveness was operationalized in terms of measurements of group members' perceptions of cohesiveness than when cohesiveness was operationalized in terms of experimental inductions of cohesiveness, The results of this analysis suggest that the more direct effect may be from performance to cohesiveness rather than from cohesiveness to performance. Discussion considers the implications of these results for future research on the relation between cohesiveness and performance.

RN 95-32 Methods of displaying multiple performance measures from simulator exercises, Mahan, R.P. April 1995. (AD A298 839) This report examines the development of a summary dis-

play system that would extend the capabilities of the Unit Performance Assessment System (UPAS) in supporting after action reviews conducted in the Simulation Networking (SIMNET) environment. The report details the initial phase of an effort to produce displays that use integral display technology in supporting after action reviews. The report discusses the Cognitive Continuum Theory as a framework that may guide the development of the summary displays. In addition, the findings suggest that general categories of combat unit actions (Move, Shoot, and Communicate) may serve as a set of global dimensions that are well suited for summary display information. Finally, an empirical study is outlined that documents the proposed next step in the summary display system project.

RN 95-33 Effects of personnel turbulence on tank crew gunnery performance: A review of the literature, Ward, K.J. April 1995. (AD A296 255) This literature review summarizes studies that examined the effects od personnel turnover and turbulence on tank crew gunnery performance. This literature is compared and contrasted to literature on the performance of flight crews. The findings appear to contradict a widely held belief that it is important to stabilize tank crews during their training.

RN 95-34 Development and construct validation of the situational judgment test, Hanson, M.A.; Borman, W.C. April 1995. (AD A296 511) This report describes the development of the Situational Judgment Test (SJT), the development and evaluation of basic SJT scores, explorations of the dimensionality of the SJT, and detailed investigations of the relationships between SJT scores and scores on

temperament, cognitive ability, and other job performance measures. The SJT was developed to be a criterion measure of supervisory job knowledge and administered to over 1,000 second-tour Noncommissioned Officers (NCOs) in the U.S. Army. These data were used, along with several rational approaches, to explore the dimensionality of the SJT. Relationships between SJT total scores, several experimental SJT subscores, and scores on the other available measures were also examined; and structural modeling was used to test several hypotheses concerning reasons for some of the relationships that were found. Finally, conclusions were drawn, based on the results of these analyses, concerning what the SJT measures.

RN 95-35 The application of propensity score theory to the measurement of the effects of military service, Fairbank, B.A. April 1995. (AD A294 380) This report focuses on the suitability or propensity score theory to determine the effects of military service on the later life of a Service participant. The limitations inherent in the non-experimental determination of the effects of service have previously precluded strong determination of cause, in part because of the bias introduced by self-selection into military service. Those who serve differ from those who do not serve in at least two ways: they have served, and they have chosen to serve. To attribute any differences later in life to the first of those variables while ignoring the second is not defensible. The present selection presents a method of simulating the phenomena so modeled, then illustrates the simulation with a sample execution. The output of the simulation is examined to determine whether plausible values of the effect of service in the output variables might reasonably be expected to be detected. The differences

built into the simulation were recovered, but were not statistically significant.

RN 95-36 Strategic leadership in a changing world order: Requisite cognitive skills, Markessini, J. April 1995. (AD A296 863) This document reviews the psychological literature for models and taxonomies of human cognition. It examines in some detail 20 such models and taxonomies by 18 theorists over a period of 67 years, from 1923 through 1989. The authors conclude that, while there are a number of interesting models, the scientific community does not have a widely accepted, comprehensive theory of cognition or a theory of learning that allows generalization of learning principles to specified complex tasks. Nor does it appear to have a consensus on the concept of intelligence. Above and beyond those considerations, there is little appearance of common purpose guiding the development of the more recently derived models of cognition. The field is more paradigm-driven than theory-driven. No taxonomy of requisite cognitive skills for executive leadership performance was found. The authors, drawing on an integration of the models and taxonomies reviewed, propose such a taxonomy.

RN 95-37 Canceled.

RN 95-38 Simulation and training for stress environments: A meta-analytic and experimental evaluation, Driskell, J.E.; Mullen, B. June 1995. (AD A297 385) A vast amount of research on stress and training has been conducted in the past several decades. This research identifies approaches that are potentially effective for stress training, but often produces conflicting results that are difficult to interpret at the narrative level. It also describes a series of

meta-analytic studies undertaken as part of a research project to integrate and summarize the research literature on stress training. The technical approach examined those training approaches that the research literature suggests may be effective for enhancing performance under stress, including overlearning, mental practice, stress inoculation training, cohesiveness, team building, and relaxation training. This approach provided the opportunity to gauge, on a quantitative basis, the overall effectiveness of alternative training approaches. Second, it allowed the identification of factors that moderate the effectiveness of these training approaches to determine the most effective means to implement a specific training approach. Finally, this strategy provided precise direction for further research and application.

RN 95-39 Group representation in european armed forces, Harries-Jenkins, G. June 1995. (AD A298 618) The trends toward the establishment of systems of group representation within Western Armed Forces has raised three important questions. First, to what extent can the European experience be identified as a valid analogue for the military forces of those other countries in which such representation is at present illegal. Second, to what extent can the systems of group representation be equated with conventionally defined trade unions? Third, what is the effect of such systems of representation upon the combat effectiveness of armed forces? A review of the existing European situation indicates that, with the possible exception of Sweden, none of the established systems can be equated with unionization. The systems can at best be defined as forms of personal associations in which the primary interest of the body is to protect its member.

RN 95-40 Transfer of skills among programming languages, Anderson, J.R. June 1995. (AD A298 506) The general picture that has emerged from this research is one in which programming skill is to be conceived as translation from one surface representation to another. While the successful student will have this surface representation annotated with rich representation of its functionality, the skill is still specific to the notational details of the representations involved. The initial context for this research was set by two things supported by a prior ARI contract. One of these was the development of a general theory of transfer of cognitive skill, which could be conceived as a modern information-processing rendition of Thorndike's theory of identical elements (Thorndike & Woodworth, 1901; Singley & Anderson, 1989). We showed that the degree of transfer could be predicted by the amount of overlap between knowledge structures in the ACT theory, which proposed that knowledge consisted of both procedural knowledge and declarative knowledge (Anderson, 1993). The other part of the research background for this project was the development of tutors for programming languages, particularly LISP (Andersen, Conrad, & Corbett, 1989). We wanted to generalize our understanding of both tutoring and programming.

RN 95-41 Conflict in the military worldview: An ethnography of an Israeli infantry battalion, Ben-Ari, E. June 1995. (AD A298 509) This report analyzed the organization of everyday military knowledge through a focus on the "folk" models that members of the armed forces have of "soldiering" and "commanding." These models are of great importance because they are basic points of reference for "what we are" and

"what we are trying to do" through which military reality is constructed. Specifically, this report represents an attempt to explore the main assumptions about, and images of, "conflict," the "use of military force," or the "enemy" that are held by soldiers and officers. This essay tackles this set of themes by examining a case study; a battalion of elite infantry reserves of the Israel Defense Forces (IDF). Based on a number of years of participant-observation, the analysis is basically ethnographic in its approach.

RN 95-42 Developing new test selection and weight stabilization techniques for designing classification efficient composites, Johnson, C. D.; Zeidner, J.; Scholarios, D. July 1995. (AD A298 740) The major goal of this research was to specify a classification-efficient methodology for the construction of assignment composites of optimally selected and weighted tests drawn from a single battery of ASVAB and experimental tests and targeting a job family. The experiments examine the effects of the number of tests included in a composite, using different figures of merit as the standard for the selection of tests for components and stabilizing test regression weights. The research approach adopted involves a simulation of the Army selection and classification process using Project A validity data. Comparisons of classification efficiency obtained under each experimental condition are reported in terms of mean predicted performance (MPP). Findings indicate that five-test composites, tailored to operational job families and selected by a predictive validity index to provide positive weights, can provide an acceptable approximation of the maximum obtainable MPP. The results confirm the predictions that the use of efficient test selection procedures and least square

weights for tests in assignment composites can improve the utility of the Army assignment process. The results show that optimal classification provides twice as much gain in predicted performance as gain from selection alone.

RN 95-43 Differential assignment theory sourcebook, Johnson, C.D.; Zeidner, J. July 1995. (AD A298 629) Differential Assignment Theory (DAT) is presented as an alternative to other current theories that pertain to personnel selection and classification, but, unlike DAT, do not provide a basis of optimism for the successful development and implementation of both selection and classification-efficient operational systems. Data focuses on the research and development of systems that can effectively accomplish: (1) selection from a common pool of applicants, and (2) the subsequent optimal assignment of selected individuals to one of a number of alternative job families. The other theories at least implicitly assume that separate applicant pools exist for each assignment destination, thus permitting the evaluation of test batteries and assignment composites in terms of incremental predictive validity, essentially ignoring the effect of the intercorrelations among selection and assignment variables. DAT is described in terms of its assumptions, concepts, and the more than 30 principles that have been hypothesized and partially tested within the context of research on DAT relevant to selection and /or classification of personnel. The authors believe that true or more accurate descriptions of the interrelations among selected variables particularly relevant to selection and classification of personnel, including system, predictor, and criterion variables, are reflected in these principles. This report provides a source of such facts and concepts useful to

the design of both research efforts and operational systems that have potential for the improvement of selection and/or classification policies, strategies, procedures, and total systems.

RN 95-44 Battalion - battle staff training system, Andre, C.; Salter, M.S. August 1995. (AD A299 228) This report documents the design and development of 13 courses of instruction for the Battalion-Battle Staff Training System (BN-BSTS). BSTS is a set of training materials for battalion-level staff officers, a mixture of text and CD-ROM computer-based instruction (CBI). Designed for stand alone or local area network linked training systems, the BN-BSTS was developed for use by the U.S. Army National Guard (ARNG). Part of the training challenge for ARNG combat arms staff members is due to conflicts with other duties. To help alleviate this problem, distributed, multimedia (paper-based and computer based), individualized instruction for battalion staff personnel was developed. The resulting BSTS project provides a prototype staff officer training program with courses which cover individual battalion staff functional areas and those individual tasks required to prepare the battle staff members for collective battle staff tasks. This project, sponsored under the Advanced Research Projects Agency (ARPA) program umbrella of Simulation in Training for Advanced Readisness (SIMITAR), is coordinated with two other programs: Simulation-Based Multiechelon Training for Armor Units (SIMUTA) and Combat Service Support (CSS) Training System Development for the National Guard.

RN 95-45 Validation of crew coordination training and evaluation methods for Army aviation, Simon, R.A.; Grubb, G.N. August 1995. (AD A298 921) At the request of the U.S. Army Aviation Center (USAAVNC), the Army Research Institute Rotary-Wing Aviation Research Unit (ARIRWARU) developed field exportable training and evaluation materials for aircrew coordination. A testbed of the materials was implemented with the cooperation of the 101st Aviation Brigade. Sixteen aircrews participated. Using a UH-60 flight simulator, aircrews were evaluated while executing a comprehensive tactical mission. Evaluation data were collected before and after aircrew coordination training was provided. Evaluation measures included attitude, behavior, task performance, and mission performance. Results showed that (1) the training had positive effects on all of the measures, and (2) the measures are sensitive to changes in performance. The impact on safety of flight was also assessed. The report concludes with recommendations and suggested areas for future research.

RN 95-46 Individual differences in the generation and processing of performance feedback, Herold, D.M.; Parsons, C.K.; Rensvold, R.B. September 1995. (AD A299 049) In this paper, we identify domain-specific measures of individual differences in feedback propensities. In a series of studies, we identify the primary dimensions, psychometric characteristics, and construct validation evidence for internal ability, internal propensity, and external propensity for feedback. Confirmatory factor analysis supports the three-dimensional representation. Correlations between the new scales and existing differences of personality are consistent with theoretical predictions. Research that has used the new scales to predict feedback-related behavior and performance is de-

scribed. Theoretical and practical extensions of the current work are discussed.

RN 95-47 Perceptual learning in the acquisition of flight skills, Lintern, G. September 1995. (AD A299 520) Many skills transfer effects observed in flight training research may be explained by an appeal to invariant perceptual properties of the task environment. If training in a simulator serves to enhance sensitivity to perceptual properties that are critical to flight performance, a high level of transfer will result. The theory forwarded here assumes that a relatively low-dimensional set of properties supports flight control. It is those properties that need not be represented accurately, or even at all. One implication of the approach outlined here is that the unquestioning pursuit of high fidelity is, in large part, wasted effort.

Research Products

RP 95-01 Integrating SIMNET into heavy task force tactical training

RP 95-01 Integrating SIMNET into heavy task force tactical training, Heiden, C.G.   October 1994. (AD A285 953) This report describes a procedure used to integrate simulation networking (SIMNET) exercises and traditional field exercises into a coordinated training plan intended to prepare an armor unit for a rotation at the Combat Training Center (CTC). The procedure outlines the development of a Battalion training plan and the training sequence to be followed during the 7 months prior to a CTC rotation. The resulting plan allows commanders to tailor the training sequence to meet unit specific training goals, thus maintaining higher combat readiness at a lower cost. Included is the SIMNET planning package (prepared by SIMNET site staff) that the unit used to plan and execute its simulation-based training.

RP 95-02 Review of division structure initiatives, Ford, P.; Burba, E.H., Jr.; Christ, R.E.   October 1994. (AD A297 578) In anticipation of more demanding challenges even as it also experiences declining resources, the Army must reshape its combat organizations to be more versatile. A likely question for this redesign effort is How have divisions evolved to their current status? The project reported here collected and evaluated 208 documents to help answer that question. The focus was set on post-Vietnam initiatives in general and the following five initiatives in particular: Triple Capabilities (TRICAP) study; Division Restructuring/Study/Evaluation (DRS/DRE); Army 86 (Heavy and Infantry Divisions and Separate Brigades); High Technology Light division (HTLD); and Army of Excellence (AOE) (Light and Heavy Divisions). This report is intended to be a source of information on previous division structure

initiatives and an overview of lessons learned from those initiatives. It contains a chronology of division design and structure initiatives, as well as an overview of each initiative and a summary of the major conceptual and organizational features pertinent to each initiative. The main body of the report concludes with a summary of overall trends, recommendations, and persistent issues. The appendices to the report contain abstracts of pertinent documents the authors identified, reviewed, and copied that relate to each of the initiatives.

RP 95-03 Combat leaders' guide: 1994 leader handbook, Salter, M.S. October 1994. (AD A286 010) The Combat Leaders' Guide (CLG) is a job performance aid for leaders to use as a memory jogger during realistic combat training like that at the Combat Training Centers or in continuous operations environments. The CLG is a pocket-sized, quick reference system to be used by trained soldiers at company, platoon, or squad level. The CLG helps to overcome the potential effects of performance decay over time and during periods of high stress and fatigue. It supports unit readiness by providing a leader with doctrinal, tactical, and technical materials in a quick reference format.

RP 95-04 Trainer's guide for the device-based, time-compressed Army National Guard tank gunnery training strategy, Morrison, J.E.; Hagman, J.D.   October 1994. (AD A286 344) This report is a guide for trainers in Army National Guard (ARNG) armor units for a device-based gunnery training strategy. The purpose of the strategy is to reduce or compress the time required to prepare for tank crew gunnery

qualifications (i.e., Table VIII). The strategy compresses the required training time by (a) limiting training to those skills and knowledges needed for successful Table VIII performance, (b) focusing training on Table VIII engagements that are most difficult to ARNG crews to perform, and (c) allocating device training time to crews that need it most and away from crews that are demonstrably proficient on the training device. The strategy is designed to be implemented at the local level with either the Conduct-of-Fire Trainer (COFT) or the Guard Unit Armory Device Full-Crew Interactive Simulation Trainer, Armor (GUARDFIST I).

RP 95-05 Combat vehicle command and control system architecture overview, Greess, M. October 1994. (AD A286 259) This Research Product describes and documents the software architecture used in the research and development effort referred to as Combat Vehicle Command and Control (CVCC). This effort was initiated in the late 80's and was conducted in the Mounted Warfare Test Bed at Fort Knox, Kentucky. CVCC incorporated futuristic requirements for command, control, and communications (C3) systems to be used by armored combat systems of the future. The nature of the program enabled an iterative approach to the development of a user-based system. This system provides modular software that can be tailored to varying levels of operational and experimental requirements. The Product also includes the catalog of CVCC software switches that support rapid configuration of the C3 features developed. Directions for future architecture development are provided in a catalog of change requests derived from user-based assessments.

RP 95-06 Canceled.

RP 95-07 Reserve component virtual training program (RCVTP) orientation guide, Turecek, J.L.; Campbell, C.H.; Myers, W.E.; Garth, T.H. March 1995. (AD A292 885) This Orientation Guide acquaints leaders of Armor, Mechanized Infantry, and Cavalry units with the Reserve Component Virtual Training Program (RCVTP). Additionally, it provides leaders with sufficient information to enable them, in coordination with the Fort Knox RCVTP Observation/Controller (0/C) team, to decide on the type of simulation to use and the echelon and level of training to conduct during an Inactive Duty Training (IDT) or Active Training (AT) period at Fort Knox.

RP 95-08 Methodology for the development of structured simulation-based training, Campbell, C.H.; Campbell, R.C.; Sanders, J.J.; Flynn, M.R.; Myers, W.E. April 1995. (AD A296 171) The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), in coordination with the Advanced Research Projects Agency (ARPA), the U.S. Army Armor School, and the U.S. Army National Guard, has sponsored development of the Reserve Component Virtual Training Program (RCVTP), This structured training program incorporates.simulation-based exercises for platoon-, company-, battalion-, and battalion staff-level training. This Research Product provides step-by-step instructions for designing and developing structured simulation-based training. The methodology is based on the RCVTP development effort, and was validated in the further development of cavalry troop exercises.

RP 95-09 The Army command and control evaluation system (ACCES 93) documentation, Hayes, R.E.; Layton, R.L.; Ross, W.A. April 1995. (AD

A296 152) This document is intended to be the basic resource for anyone attempting to use the Army Command and Control Evaluation System (ACCES) to measure command and control performance during a freeplay command post exercise at the division level. The ACCES system is appropriate for use at the brigade and corps levels also, but has rarely been used for other than division level exercises. A comprehensive description of AC-CES, its development, and its promise is available in Halpin (1995). This report provides a description of ACCES Version 93 and is current as of the end of December 1993. No further modification of the ACCES methodology is planned at this time. Included as appendixes to this document are the materials necessary for learning how to conduct an AC-CES application. They are the result of 3-year contracts with Evidence Based Research, Inc,, for specific enhancements to the ACCES system and with Quantum Research International for support in data collection and analysis. Appendix A comprises the nine lessons of the data collectors' pro-gram of instruction (DC-POI). Appendix B is the Analyst's POI. Appendix C is the Analyst's Guide. Appendix D gives specific definitions of the ACCES measures. Appendix E contains the Data Collection and Reduction Forms.

RP 95-10 Prototype U.S. Army National Guard armor and mechanized infantry training database: User's manual, Clifton, T.C. May 1995. (AD A298 562) This manual provides how-to guidance on use of a prototype database developed by the U.S. Army Research Institute to support short- and long-term effectiveness assessment of training strategies employed by armor and mechanized infantry units of the U.S. Army National Guard. Information is provided on how to create, retrieve, edit, and analyze database files developed through use of the Statistical Package for the Social Sciences for Windows, version 6.1. A data element dictionary is also provided wherein the contents of each data file are described.

Research Reports

RR 1667 Reacquisition of skills by combat engineers mobilized from the individual ready reserve, Kern, R.P.; Wisher, R.A.; Sabol, M.A.; Farr, B.J. October 1994. (AD A286 244) For this report, skill reacquisition data were collected during a mobilization training exercise on 76 individual ready reserve (IRR) soldiers (combat engineers) who had been separated from active duty for periods ranging up to 10 years. Military occupational knowledge was measured before and after a 5-day rapid train-up and hands-on performance for 18 MOS tasks was recorded. Increases in task knowledge were strongly related to prior active duty status (full tour vs. initial entry training only) and Armed Forces Qualification Test (AFQT) scores (above vs. below the 50th percentile). Time since separation from active duty did not have a systematic effect. Although these findings cannot be generalized beyond the procedural-type skills examined, the results are evidence for a need to reconsider the current IRR mobilization guideline based solely on separation time. These findings suggest that active duty status, AFQT scores, and a separation window as long as 36 months can serve as determinants of potential for rapid reacquisition of critical skills during a mobilization.

RR 1668 Measuring mass and speed at the National Training Center, Goehring, D.J.; Sulzen, R.H. October 1994. (AD A286 282) In this report, a method is proposed and tested for measuring the massing of ground forces in force-on-force simulated combat. The relationship of the mass as well as the speed of an attacking force to attrition-based performance is explored. The researchers used archival data generated at the National Training Center, Fort Irwin, California. Successful attacking task forces were found to have had greater massing and to have closed with the opposing force at higher speed. The methodology developed demonstrates the high potential for using existing data from the National Training Center for theoretical research with practical training implications.

RR 1669 Performance analysis of table viii tank gunnery engagements, Hagman, J.D. October 1994. (AD A286 186) To assess performance on individual Table VIII gunnery engagements, the first-run scores of 109 tank crews from three U.S. Army National Guard (ARNG) armor battalions were averaged and then ordinally ranked for difficulty. For all three battalions, three of the four engagements found to have the lowest average scores (highest difficulty rankings) required machine gun (coax or Caliber .50) employment either alone or in combination with the main gun. In the remaining engagement of this foursome, crews were required to fire at multiple targets with the main gun using the gunner's auxiliary sight. Two of the three engagements found to have the highest average scores (lowest difficulty rankings) involved presentation of only a single target. These results can be used by ARNG armor trainers to help maximize the payoff from their training time investment by focusing on the engagements found to be the most difficult, thereby enhancing the probability of first-run crew qualification on Table VIII.

RR 1670 Peace operations: Workshop proceedings, Segal, David R. October 1994. (AD A292 116) Conceptualization of changes in peace operations, and the experience of Americans and allied military

forces in such operations, were the focus of a 1993 U.S. Army Research Institute for the Behavioral and Social Sciences workshop. The purpose of this workshop was to identify what we know and what we still need to learn about how to screen, select, and train soldiers, units, and leaders for increasing American participation in operations other than war, particularly in a multinational context. Experiences considered ranged from the Multinational Force and Observers in the Sinai to Operation Restore Hope in Somalia.

RR 1671 A simulation-based evaluation of a force protection system: Soldier performance, training requirements, and soldier-machine interface considerations, Elliott, G.S.; Wong, D.T.; Dreby, C.A.; Jarboe, J.E.   February 1995. (AD A292 806) This soldier-in-the-loop evaluation, part of Tank Automotive Research, Development, and Engineering Center's (TARDEC's) ongoing hit-avoidance research effort, used a simulated prototype Vehicle Integrated Defense System (VIDS) as its conceptual protection system. VIDS is composed of a system of sensors and countermeasures and a counterfire system regulated by an artificial intelligence module to assist the operator to defend the vehicle. Platoon command survivability and lethality while using the M1 tank with and without VIDS was examined. Research objectives were to (a) determine if VIDS enhanced platoon combat operational effectiveness, (b) determine the optimal VIDS configuration, (c) identify future training requirements and soldier-machine interface issues, and (d) identify impacts on tactics, techniques, and procedures. Findings indicated VIDS-equipped platoons survived significantly better and progressive additions of sensors and countermeasures enhanced platoon survivability.

The effects of VIDS on lethality performance was negligible.

RR 1672 Planning in the Special Forces operational detachment alpha, Morrison, J.E.; Smith, D.H.; Sticha, P.J.; Brooks, J.E.   February 1995. (AD A292 723) The objectives of this study were to identify individual and collective processes that characterize both effective and ineffective planning in the Special Forces (SF) Operational Detachment Alpha (ODA) and to suggest training enhancements. During Phase I, interviews with SF experts indicated that ODA commanders and their staffs are deficient in skills and knowledges related to mission analysis and intelligence preparation of the battlefield (IPB). During Phase II, the authors reviewed archival data and observed ODA planning during a single rotation at the Joint Readiness Training Center (JRTC). ODAs that were "strong" in mission analysis (a) generated more effective implied tasks resulting from analysis and relating to other mission elements; (b) recognized a wider variety of constraints and were more likely to include constraints directly related to the threat; and (c) were more likely to revise courses of action (COAs) or method of evaluation based on the results of their evaluation. ODAs that were "weak" in IPB (a) did not analyze the effects of weather and terrain on their mission, (b) did not develop an appropriate reconnaissance and surveillance (R&S) data collection plan, (c) may produce lower quality IPB products, and (d) may determine enemy COAs less effectively.

RR 1673 Computer-supported simulation at the National Fire Academy: Lessons learned for incident command training, Mirabella, A.; Macpherson, D.   April 1995. (AD A295 789) The

U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) and the National Fire Academy (NFA) are pursuing a joint effort to transfer training and training development technology from the U.S. Army to the Federal Emergency Management Agency (FEMA). The goal of the effort is to enhance emergency management training through computer-supported simulation. The Army's research on simulation-based unit training and tactical decision making can benefit NFA. This report summarizes results of an initial effort to transfer Army experience to the Academy. The report describes NFA simulation methodology as a baseline from which future upgrades will be made and recommends ways to introduce computer-aiding to support management of simulation exercises and performance assessment. The recommendations address the near-term goal of introducing computer-supported simulations at the NFA campus and the long-range goal of distributing simulation nationwide.

RR 1674 Effect of crew composition on AH-64 attack helicopter mission performance and flight safety, Grubb, G.N.; Simon, R.A.; Leedom, D.K.; Zeller, J.L. April 1995. (AD A294 051) This report evaluates battle rostering (pairing crew members on a long-term basis) by comparing AH-64 attack helicopter crews when flying in battle-rostered and mixed crew compositions. Participants in the experiments were AH-64 attack helicopter standardization instructor pilots and 12 battle-rostered aircrews consisting of a pilot and a copilot gunner. All participants received training in the Army's Aircrew Coordination Exportable Training Package as a prerequisite for the experiment. Participating aviators conducted two missions in a battle-rostered crew and two missions in a mixed-crew. Discussion and analysis of crew

performance are presented as measures of behavior, task performance, mission performance, and participant exit interview comments. The experiment concluded that minimal evidence exists to show that battle rostering provides meaningful improvements in the mission performance or flight safety of crew coordination-trained aircrews. Battle rostering drawbacks include overconfidence and increased reliance on implicit communication and coordination. The report recommends implementing actions to improve mission effectiveness and flight safety and follow-on research to better understand and capitalize of the strengths of crew and team coordination.

RR 1675 Developing the reserve component virtual training program: History and lessons learned, Hoffman, R.G.; Graves, C.R.; Koger, M.E.; Flynn, M.R.; Sever, R.S. April 1995. (AD A296 153) This report describes the development of the Reserve Component Program (RCVTP) for training U.S. Army National Guard (ARNG) armor units using the simulation technologies of Simulation Networking (SIMNET), Janus, and an automated tactical operations center simulator called the Commander/Staff Trainer (C/ST). The report presents the project's background, including the conceptualization of the RCVTP by the contracting agency, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), and the contractor team's proposal for operationalizing ARI's conceptualizations. Three of the major goals of the RCVTP are to emphasize execution, to compress training time, and to reduce training management by providing a turn-key program for the ARNG. The report summarizes the design and development of the RCVTP's platoon-, company-, and battalion-level exercises and their training management materials. Significant de-

sign issues discussed include identifying tasks appropriate for training in designated simulated environments and incorporating specified design concepts through the process of outlining the training exercises. The development of the exercises and the training management materials is discussed in light of their relationship to the design principles and in terms of their relevance to the final RCVTP product. The report describes the formative evaluation and presents findings in the context of the developmental framework. Finally, the report documents the process of extending the developmental methodology through the creation of cavalry troop exercises and identifies lessons learned.

RR 1676 An automated system for the analysis of combat training center information: Strategy and development, Goehring, D.J. May 1995. (AD A297 143) This report explains the rationale for and development of automated systems for the analysis of Combat Training Center archive information. Such systems are justified in terms of need, reuse, and technological advances in computer hardware and software. The Automated Force Concentration Measurement System, which serves as an example of a successfully developed system, illustrates the advantages of the approach using data from National Training Center simulated combat field training exercises. The system efficiently replicates earlier research findings regarding the massing of attacking forces.

RR 1677 Sinai task leaders at the infantry leaders course, Salter, M.S.; Fober, G.W.; Pleban, R.J.; Valentine, P.J. June 1995. (AD A304 231) The senior leaders of the 4-505 Parachute Infantry Regiment (PIR) Multinational Force and Observers

(MFO) Sinai Task Force deployed from Fort Bragg, NC, to Fort Benning, GA, from August 26, 1994 through September 23, 1994, to attend the Infantry Leaders Course (ILC). The 4-505 is a composite or "experimental" battalion, both in its composition and in its availability to accomplish the MFO Sinai peacekeeping mission. In leadership positions, half are Regular Army, the other half National Guard or Army Reserve. The ILC, specializing in Infantry doctrine and tactics and collective Infantry skills, was the initial training event for 154 leaders of the newly constituted battalion and their first opportunity to function as a group. Data were collected through written questionnaires, interviews, and first-hand training observations. Research questions focused on training and within unit bonding. Observations confirmed that the composite battalion would be able to conduct its mission; the leaders were trained. Those with skill deficiencies were highly motivated and benefitted most. Early concerns over unit cohesion focused on the Active/Reserve mixture and whether the two elements could be combined and work together. Concerns proved unfounded, as the members of the units readily accepted each other as members of the common MFO unit.

RR 1678 Shooting with night vision goggles and aiming lights, Dyer, J.L.; Smith, S.; McClure, N.R. June 1995. (AD A297 284) Aiming lights, zeroed to the M16 rifle and used with night vision goggles (NVGs), provide soldiers an enhanced night firing capability. However, aiming lights are difficult to zero. Firers have difficulty in getting initial shot groups on the 25-m zero target, from which aiming light adjustments must be made, and in aiming consistently during live-fire zeroing, because of the bloom of the aiming light and reduced visual acuity

through NVGs. Research addressing both problems was conducted. Modifications to the 25-m live-fire zero procedures resulted in smaller shot groups, enabled firers to zero with fewer shot groups, and yielded higher hit performance compared to current zeroing procedures. Good NVG acuity settings resulted in smaller shot groups and in higher hit performance than poor settings. A dry-fire zero procedure increased the likelihood of getting initial shot groups on paper, compared to the manufacturer's mechanical adjustment, and could substitute for live-fire zeroing in emergency deployment situations. The revised procedures use readily available materials and apply to AN/PAQ-4A and AN/PAQ-4B aiming lights.

RR 1679 An initial evaluation of a simulation-based training program for Army National Guard units,
Shlechter, T.M.; Bessemer, D.W.; Nesselroade, K.P.; Anthony, J. June 1995. (AD A297 271) This research effort was designed to provide initial empirical information needed to examine the Reserve Component Virtual Training Program's (RCVTP's) instructional effectiveness. A multimethod-multisource research strategy was u$ed to address this objective. Observers collected data from 9 units, who executed 45 tables (exercises); 14 RCVTP instructors completed standard rating forms regarding the performance of 38 armored force units; and 280 training participants completed Likert-scale items regarding their training experience. Data from the different methods indicated that the units further developed their collective tactical skills across the training period. They took significantly less time, made fewer errors, and needed less coaching as their training progressed. The instructors indicated that most units had a greater likelihood of be-

coming more proficient in critical subtasks than either not improving or becoming less proficient. The participants claimed that they were more proficient after training than before. The RCVTP should continue to be used to train Army National Guard armored units.

RR 1680 Helicopter simulator sickness: A state-of-the-art review of its incidence, causes, and treatment, Wright, R.H. June 1995. (AD A297 285) For this report, helicopter simulator sickness literature was reviewed and analyzed to estimate the scope of the problem in the Army. The author concluded that pilot reluctance to divulge symptoms, in combination with the survey methods used, leads to underestimation of the incidence and severity of symptoms. Lack of truly anonymous survey procedures and potential adverse flying career consequences are suggested as reasons that the more severe symptoms and aftereffects may not be reported in surveys. Potential adverse career impact is also suggested as a probable reason for failure to find any relationship between simulator sickness aftereffects and accidents or safety incidents. Guidelines are suggested for minimizing the development of simulator sickness and the safety consequences of its aftereffects.

RR 1681 A comparison of two alternative velocity vector cue combinations for the AH-64d integrated helmet and display sight subsystems, Stewart, J.E. II. June 1995. (AD A298 320) The AH-64A employs an integrated helmet and display sight subsystem which presents night vision system and flight data to the pilot's right eye. Velocity vector and acceleration cues tell the pilot when the aircraft is accelerating, its speed, and vector. A 6 kt cue is used for hovering; a 60 kt cue for transition. A single 20 kt cue was proposed for the

AH-64D. The requirement was dropped, but the question remained as to whether the 20 kt cue provided any advantage. The experiment was conducted to answer this question. Ten AH-64A pilots performed a mission consisting of seven Aircrew Training Manual (ATM) tasks, under 1-day and 2-night conditions (6/60 kt and 20/60 kt cues) in the simulator training research advanced testbed for aviation (STRATA). The STRATA copilot-gunner station was used with a rear-projection display. Of 210 task events, 209 met ATM standards. Performance across all tasks was better in the 6/60 than in the 20/60 condition (p.04, two-tailed). Performance on stationary hover reached significance (p.05) and approached significance for "three other hovering tasks. Results supported retention of the 6 and 60 kt cues.

RR 1682 Canceled

RR 1683 Intercultural communication requirements for Special Forces teams, Russell, T.L.; Crafts, J.L.; Brooks, J.E.   July 1995.   (AD A298 798)

Communicating effectively with individuals from different cultures is essential for Special Forces (SF) teams. SF soldiers must possess language skills, interpersonal skills, cultural knowledge, as well as nonverbal skills, to do their job of conveying technical skills and knowledge to indigenous troops, negotiating resources and plans, and developing positive regard for the United States and SF. The goal of this project was to identify critical performance dimensions relevant to intercultural communication for SF and appropriate intercultural training topics. The approach involved reviewing the published literature, analyzing existing critical incident data, and tying intercultural communication performance categories to the content of current training courses. The analyses resulted in a set of eight intercultural communication performance categories for SF. The categories vary in the level of intercultural skill requirements—from basic awareness, to knowledge of the specific culture, to application of intercultural skills. The findings include specific suggestions for enhancing the training SF soldiers receive in intercultural communication.

Study Notes

**SN 95-01 Contract for manpower and
personnel research and studies (COMPRS) for the U.S. Army Research Institute   Annual Report,**
HumRRO. November 1994. (AD A290 536)
This report documents the first year of a 5-year project to provide the U.S. Army Research Institute for the Behavioral and Social Sciences short- and medium-term scientific and technical support in solving problems related to manpower and personnel. The three Contract for Manpower and Personnel Research and Studies (COMPRS) Programs are (1) quick reaction; (2) attitude and opinion surveys; and (3) medium term. During the first year of the contract, 27 delivery orders were initiated. This report includes examples of problem and objective statements and summaries for each delivery order (including problem, objectives, status, results, bibliography, products, and planned documents and products). The intent is to give a very brief overview of each effort.

SN 95-02 Canceled.

Study Reports

SR 95-01   Critical factors in the art of battle command, Lussier, J.W.; Sacon, T.F.   November 1994.   (AD A290 858)   This study report focuses on the re-emergence of the importance of the art of battle command and the factors critical to it. First, the conceptualization of battle command is discussed. Included in this discussion is how the concept of battle command differs from the concept of command and control, the consideration of battle command as an art and science, and the place of technology, information, and digitization in the concept of battle command. Drawing on National Training Center studies, traits of leaders, and the differences between experts and novices, the various competencies commonly associated with battle command are analyzed. In keeping with the current BCBL conceptualization of battle command, two fundamental aspects of battle command, leadership and decision making, are discussed. Research from both the military and non-military sector is presented on leadership and decision making and its relevance to battle command. Specifically, regarding leadership, the topics of leadership skills, leadership styles, communication, and training are discussed. With respect to decision making, the roles of intuitive and analytical judgments, planning and problem solving, critical thinking, and visualization are considered.

SR 95-02   The U.S. Army survey of registered nurses and the U.S. Army survey of nursing students: Methodology and results, Ramsberger, P.F.; Barnes, J.D.; DiFazio, A.S.; Tiggle, R.   April 1995.   (AD A296 605)   This report details the methodology of and preliminary results from surveys of registered nurses (RNs) and nursing students. Representative samples of each were selected and their attitudes toward various aspects of nursing, and military nursing in particular, were assessed. The results indicate that there is a great deal of similarity between current and future RNs in terms of reasons for entering the field and positive and negative influences in that regard. Overall, current nurses were satisfied with their field, although there were areas of significant dissatisfaction (e.g., the amount of paperwork). The level of familiarity with the Army Nurse Corps (ANC) was high, and many aspects of the ANC were attractive to both current and future RNs. However, the possibility of relocation, chance of serving in/around combat, prospect of weekend Reserve duty, and military lifestyle were seen by large portions of each sample as being negative attributes of military service. Interest in enlisting in the ANC was fairly low among both groups, with significant portions of respondents indicating that the probability that they would join was smaller following Operations Desert Shield and Desert Storm.

Technical Reports

TR 1009 Predicting Table VIII tank gunnery performance from M-COFT hit rate, Smith, M.D.; Hagman, J.D. October 1994. (AD A285 904) To determine the relationship between scores on a device-based test of gunnery proficiency and live-fire Tank Table VIII scores, a pooled sample of 73 Army National Guard (ARNG) tank crews (i.e., 24 from Smith and Hagman (1992) and 49 from this investigation) completed a 1-hour gunnery proficiency test on the Mobile Conduct-of-Fire Trainer (M-COFT) and then fired Table VIII the next day as part of annual training. For this pooled sample, a significant correlation was found between M-COFT test and Table VIII scores ($r = .67$, p .0001). Based on the results of linear regression analyses, a tool was developed to predict Table VIII scores from M-COFT test performance measured in terms of hit rate or, easier to calculate, percentage of first-round kills. Although field tryouts are needed to verify the accuracy of the predictions, the results in this report suggest that device-based prediction of live-fire tank gunnery performance is possible, and that this prediction capability can be used by ARNG company commanders to assess the proficiency of tank crews and their need for additional training before live-fire gunnery evaluation on Table VIII.

TR 1010 A review of the literature on part-task and whole-task training and context dependency, Teague, R.C.; Gittleman, S.S.; Park, O. October 1994. (AD A285 954) For this report, the part-task and whole-task training and context-dependent and context-independent presentation literature was reviewed. For part- / whole-task training, the influences of early research on the selection of training methods relationships between training methods and task characteristics and trainees' individual differences, and different methods of part-task training were discussed. For context-dependent/independent presentation, early research findings, relationships between trainees' cognitive styles and the presentation methods, presentation methods and transfer of training, and presentation methods and trainees attention were discussed. Generally, the research showed that whole-task training is the preferred method if the task is simple and can be reasonably approximated by the trainee. However, if the task is dangerous or highly complex and can be easily divided into subtasks, part-task training is the better choice. Context-dependent methods are favored over context-independent methods for recall and recognition. However, if the acquired knowledge and skills must be selectively applied in a variety of situations, context-independent presentation methods are recommended.

TR 1011 Training dismounted soldiers in virtual environments: Task and research requirements, Jacobs, R.S.; Crooks, W.H.; Crooks, J.R.; Colburn, E.; Fraser, R.E. II; Gorman, P.F.; Maden, J.L.; Furness, T.A. III. October 1994. (AD A286 311) For this report, research was conducted to investigate the suitability of virtual environments (VE) for individual combatant training. The behaviors required by selected Dismounted Infantry and Special Operations Forces missions were linked to estimates of the availability of VE technology to support their performance. A baseline research plan was then developed as a series of vignettes in which research participants would perform the activities in clusters with similar technol-

ogy demands and performance characteristics. Subsequent experiments and demonstrations were proposed to combine the activities into complete Army Training and Evaluation Program tasks. Functional requirements for a VE testbed were identified, and possible hardware and software elements were defined. No missions or tasks can be fully supported by VE at this time, but most can be partially supported. This report provides a link between dismounted soldier tasks and estimates of the VE characteristics required to support their simulated execution and training. This information will be useful in making decisions about acquisition of or investment in the development of VE technology to support dismounted combatant training.

TR 1012 A device-based, time-compressed strategy for Army National Guard tank gunnery training, Morrison, J.E.; Hagman, J.D.   October 1994.   (AD A286 278)   This report describes a training strategy to reduce or compress the time needed to prepare for tank crew qualification on Table VIII through use of the Conduct-of-Fire Trainer (COFT) and Guard Unit Armory Device Full-Crew Interactive Simulation Trainer, Armor (GUARDFIST I). To compress time, the authors recommend that training (a) be focused on only those gunnery skills needed for Table VIII qualification, (b) be given only to crews with demonstrated performance deficiency, and (c) be devoted to those Table VIII engagements found to be most difficult. The strategy is designed specifically for use by armor units of the U.S. Army National Guard.

TR 1013 Interactive hypermedia for tactical training, Goehring, J.D.   October 1994.   (AD A286 051)   This effort applied the technology of hypermedia to the problem of organizing and presenting field training exercise data to provide training for military personnel using recent advances in informational science computer hardware and software technology. The data produced during a large-scale training exercise was structured into a hypermedia-based proof-of-principle system for training ground war tactics. The prototype lesson, which runs on a 286-based MS-DOS computer, features hypermedia structuring of textual information and high-resolution color static and dynamic graphics. The findings of this effort will contribute in several ways to future work in this area. (1) Future work can build directly upon the progress achieved in this project. (2) Guidelines are presented for resources necessary for a full-scale development of a tactical training system based on interactive hypermedia technology. (3) This project shows the value of a hypertextual approach as a way of organizing and integrating diverse types of training exercise data for use in computer-based training but with potential for a variety of other uses.

TR 1014 Measuring presence in virtual environments, Witmer, B.G.; Singer, M.J.   October 1994.   (AD A286 183) A primary argument for the efficacy of Virtual Environments (VE) applications is that the user is "present" in the simulated environment. Presence is defined as the subjective experience of being in one environment (there) when physically in another environment (here). Presence may be based on external factors and internal tendencies that support both awareness of the current situation and the transition from the immediate physical location (here) to a remote or artificial environment (there). These factors are labeled as immersive because they may lead to the experience of presence. Some major im-

mersive factors identified in current literature or hypothesized as contributing to presence are briefly reviewed in this report.
These concepts and ideas have been used as the basis for two questionnaires. An Immersive Tendencies Questionnaire (ITQ) was developed to investigate possible correlates that may indicate an individual's tendency to experience more or less presence in artificial environments. The Presence Questionnaire (PQ) addresses different factors or features peculiar to the artificial environment that may affect the experience of presence, or the capability to immerse oneself, in that environment. The results of administration of these questionnaires, in conjunction with an experiment on the performance of basic tasks in VE, are presented. These results should be considered preliminary and interpreted with caution because of the small number of subjects involved. Analyses indicate reasonable reliability values for the ITQ and PQ. An investigation of some subscales and performance measures indicates a relationship between some subscales and performance of movement and manipulation tasks. Correlations between the PQ and a standard Simulator Sickness measure revealed significant negative correlations both between the overall scores and several subscales. These results are discussed in connection with revisions made to the scales and plans for further research.

TR 1015 Predicting land navigation performance in the Special Forces qualification course, Busciglio, H.H.; Teplitzky, M.T. October 1994. (AD A289 792)

This research examined performance on the land navigation field test administered in the Special Forces Qualification Course (SFQC) as a function of three sets of possible predictors: (a) Project A paper and pencil tests of spatial ability (Map, Maze, and Orientation), (b) performance on the military orienteering events in the Special Forces Assessment and Selection program (SFAS), and (c) measures of intelligence and physical fitness obtained in SFAS. Our multivariate analyses showed that SFQC trainees who passed the land navigation test on the first try had significantly higher scores on the Map test than those who did not. We also found that those who failed land navigation had significantly lower ratings on orienteering Event IV (the last and longest event in SFAS) than did those who passed land navigation either on their first try or on a retest. Analyses of hypothetical cut-scores on the Map test were examined to provide information on the potential utility of this measure as a screening tool. The benefits (i.e., higher success rates when the cut-offs were used) were marginal because even very lenient cut-offs would exclude many students with the potential to pass land navigation. The Map test and military orienteering scores might, however, be useful as diagnostic tools. Students with low scores could be advised that they are likely to be at a disadvantage in the SFQC and instructed to improve their map reading and navigation skills before attending. For purposes of selection screening, we are planning research with another Project A spatial test, Assembling Objects, that has shown great promise in previous settings.

TR 1016 Personnel enlistment testing, job performance and cost: A cost-effectiveness analysis, Harris, D.A.; McCloy, R.A.; Dempsey, J.R.; DiFazio, P.F. October 1994. (AD A289 908) The goals of this project were to (1) describe existing military selection and classification procedures, (2) formulate a set of alternative models, (3)

develop an evaluation framework and associated criteria for comparing the cost-effectiveness of alternative models, and (4) assess the feasibility of the evaluation procedures. Previous reports addressed the first three goals. This report describes the pilot test of a cost-effectiveness model to evaluate alternative selection and classification models. The Selection and Classification Evaluation Model (S&CEM) considered both desired level of performance and the costs of obtaining that performance goal. The S&CEM combined performance prediction equations with training, compensation, and recruiting costs. Next, a linear programming algorithm was used to solve for the most cost-effective mix of recruits that would meet the performance goal. The effectiveness and efficiency of a single-stage simultaneous selection and classification model were demonstrated by evaluating four test batteries. The value of each test battery was estimated as the cost necessary to meet a fixed performance goal. Strengths and weaknesses of the S&CEM are discussed.

TR 1017 Tacit knowledge in military leadership: A review of the literature, Horvarth, J.A.; Williams, W.M.; Forsythe, G.B.; Sweeney, P.J.; Sternberg, R.J.; McNally, J.A.; Wattendorf, J. October 1994. (AD A291 140) This report reviews the theory of tacit knowledge and its theoretical and empirical background. The authors propose a three-category structure for the tacit knowledge in military leadership: intrapersonal, interpersonal, and organizational. That structure was derived from instances of leadership tacit knowledge inferred from a review of military trade journals, military "lessons learned" publications, and military memoirs. The report presents instances for the three categories. The proposed structure and representing instances

are discussed in terms of (1) tacit knowledge in civilian business management; (2) U.S. Army leadership doctrine; (3) applicability across organizational levels of the U.S. Army (battalion, company, and platoon); and (4) the likelihood of further elaboration and replication of the proposed structure with application of other data collection methods.

TR 1018 Tacit knowledge in military leadership: Evidence from officer interviews, Horvarth, J.A.; Forsythe, G.B.; Sweeney, P.J.; McNally, J.A.; Wattendorf, J.; Williams, W.M.; Sternberg, R.J. October 1994. (AD A289 840) Eighty-one U.S. Army officers representing three organizational levels (platoon, company, and battalion) and all three branch categories were interviewed to elicit stories and observations revealing tacit knowledge for military leadership: the practical, action-oriented, leadership knowledge they had learned from practical experiences. Analyses of interview materials produced items of tacit knowledge for military leadership that were then cluster analyzed to identify groupings of knowledge. Results of the interviews are described with respect to patterns across leadership levels in the quantity, structure, and content of tacit knowledge for military leadership; implications of the patterns for development through experiential learning; and the functions of tacit knowledge in making concrete or augmenting Army leadership doctrine.

TR 1019 Effects of leader support in the work unit on the relationship between work spillover and family adaptation, Bowen, G.L. October 1994. (AD A289 859) This research examines the direct and the buffering effect of leader support in the work unit on the relationship between work spillover and family adaptation. The

analyses use data from a probability sample of 3,190 married soldiers in the U.S. Army who participated in the 1989 Army and Family Survey; the results are partitioned by the gender of the respondent. Two types of work spillover are examined in the analysis (energy and time interference), and both an internal and an external type of family adaptation are hypothesized and supported by the empirical analysis. Only modest support is found for the buffering effect hypothesis. Leader support buffers the negative effect of energy interference on the internal adaptation of female soldiers. In support of the direct effect hypothesis, the findings indicate that leader support in the work unit decreases perceptions of work spillover (a "preventive" effect and enhances perceptions of external adaptation (a "therapeutic" effect). In general, the nature and size of estimated effects are similar for males and females. Recommendations are offered for further research, and implications of the findings are discussed for improving the quality of leader support for soldiers in the unit.

TR 1020 Understanding problem solving strategies, Pounds, J.F.; Fallesen, J.J. November 1994. (AD A290 350)
The way in which problems are solved can have a dramatic impact on success. This report discusses the role strategies have in thinking processes, metacognition, planning, expertise, and decisions. The report also provides a description of each of 66 strategies identified in psychological studies. The strategies have been grouped into three classes with three subordinate categories each. The classes of strategies are managing information, controlling progress, and making choices. The categories include considering hypotheses, combining information, managing the amount of information, ordering proc-

esses by hierarchical structures, sequencing processes, ordering processes by merit, managing the number of options, using compensatory choice, and using noncompensatory choice. The report discusses the adaptive nature of strategies and how this information can be used to improve military problem solving. Notably, strategies have a specific contribution to make in the study of expertise, in defining decision aid requirements and in developing training programs. The principal conclusion was that existing definitions of strategies underrepresent everyday problem situations and that actual strategies need to be observed, defined, and assessed for improvement. A general plan of research is outlined for improving military problem solving.

TR 1021 Combat vehicle command and control system evaluation: Vertical integration of an armor battalion, Lickteig, C.W.; Collins, J.W. III. February 1995. (AD A292 718) The U.S. Army is forging an integrated, digitally linked, force that will fight from a common real-time battle map to win the information war anticipated on the battlefield. Vertical integration that digitally links all echelons in a combat unit, such as a battalion, is required for full force integration. This Combat Vehicle Command and Control (CVCC) evaluation assessed the operational effectiveness of an armor battalion with digital connectivity between its platoon, company, and battalion echelons. Two hundred ten soldiers in duty assignments participated, including a fully manned, point platoon operating under company- and battalion-level commanders. The operational setting comprised a series of offensive maneuvers that required the point platoon's high-tempo response in a dynamic battlefield setting. The findings indicate that vertically linked digital Command and Control (C2) sys-

tems provide significant advantages over voice-only communications on important battlefield functions under each of the tactical Battlefield Operating Systems tested: Maneuver, Fire Support, Command and Control, and Intelligence. The method used in this evaluation provided an example of how simulation-based technologies can meet future C2 training and evaluation requirements.

TR 1022 Training dismounted soldiers in virtual environments: Route learning and transfer

, Witmer, B.G.; Bailey, J.H.; Knerr, B.W. February 1995. (AD A292 900) The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is conducting a research program with the goal of using virtual environments (VE) to train dismounted soldiers. To accomplish this goal, the conditions necessary for transfer of training from VE to real-world environments must be identified. This paper describes an experiment in which a VE computer model of a large office building is used to train spatial knowledge as it relates to learning routes through that building. This task is especially relevant to mission rehearsal of a hostage rescue attempt or other missions performed by Special Operations forces. Sixty college students studied directions and photographs of landmarks for a complex route, then rehearsed the route using either the VE model, the actual building, or verbal directions and photographs, Everyone was then tested in the actual building. Building-trained students made fewer wrong turns than did VE-trained students, who in turn made fewer wrong turns and took less time to traverse the route than did verbally trained students. The results indicate that individuals can learn how to navigate through real-world places by training in a virtual environment.

TR 1023 Special Forces qualification course graduation and attrition statistics for soldiers selected for training in FY89-FY91

, Diana, M.; Teplitzky, M.L.; Zazanis, M.M. February 1995. (AD A292 902) The Special Forces Qualification Course (SFQC) Longitudinal Database tracks individuals and cohorts of individuals through the Special Forces (SF) assessment and training pipeline—from the Special Forces Assessment and Selection (SFAS) program through each attempt to successfully complete the SFQC. This report addresses six questions concerning individual graduation/attrition and recycle rates over time and across SF Military Occupational Specialties (MOS) for SFAS candidates selected from classes conducted between fiscal year 1989 (FY89) and FY91. Three results are especially noteworthy. First, examination of graduation rates shows 18D training to be the most difficult to complete, especially for lower ranking soldiers (i.e., Specialists). Second, there is a downward trend in graduation rates from FY89 to FY91; this decline is especially pronounced for the medic training track. Third, results show that soldiers from combat arms, as opposed to non-combat arms, backgrounds were more likely to succeed at the SFQC. The potential impact of these results for predicting how many soldiers will make it through the selection and training pipeline and for identifying soldiers who are most likely to succeed is discussed.

TR 1024 Investigation of a background data measure of social intelligence

, Zaccaro, S.J.; Zazanis, M.M.; Diana, M.; Gilbert, J.A. March 1995. (AD A298 832) Some current measures of social intelligence have been judged as weak and ineffective, despite attempts to develop measures that do not emphasize verbal ability. This pa-

per examines the construct validity of a background data, or life history measure, of social intelligence. Analyses suggest that the measure has high reliability, convergent validity with other measures of verbal intelligence. Criterion-related validity is supported using an individual's peer ranking of performance effectiveness in a team setting. Results suggest that further examination of a background data measure of social intelligence is warranted, and its relationship to individual performance should be investigated in a variety of appropriate team settings.

TR 1025 Virtual reality psycophysics: Forward and lateral distance, height and speed perceptions with a wide angle helmet Display, Wright, R.H. April 1995. (AD A294 027) Psychophysics of a color, high resolution, very wide angle, virtual reality type of helmet-mounted display were investigated. Subjects used a joystick to set their viewpoint within a computer-generated image database to requested target values in forward and lateral distance, height, and speed. Test factors for each type of perception included helicopter flying experience, replications, 3-D with familiar objects or 2-D texture visual databases, relative or absolute perceptions, viewpoint motion rail row and column offsets, increasing or decreasing change in target values, and six target values. Median forward distance and speed perceptions were 41% of simulated physical stimuli, 50% for lateral distance, and 72% for height. These accuracies contrast with typical real-world accuracies for similar ranges of about 90% for distance, height, and speed. Main effort differences between most of the test factor levels were highly significant for all four types of perceptions.

TR 1026 Survey of total Army military personnel (STAMP): Analysis of active duty and reserve/guard Army nurse corps data, Ramsberger, P.R.; Difazio, A.S. May 1995. (AD A295 899) Data collected from Army Registered Nurses (RNs) as part of the Survey of Total Army Military Personnel (STAMP) are examined in this report. The principal goal of the analyses was to isolate those factors related to retention decisions. That is, what are the correlates with the decision to remain in or leave the Army Nurse Corps (ANC). Because of the large volume of data collected as part of STAMP, a series of factor analyses were performed. For Active Duty personnel, 33 composites were formed; 26 were found for the Reserves. These were then entered into a series of multiple regressions along with individual variables that did not load on any of the factors. For both components, anxiety regarding the downsizing, job-satisfaction and commitment, years of service, and whether one anticipated serving during combat were significant predictors of retention plans. Family-related concerns entered into prediction equation for Active Duty personnel; concerns over future mobilizations were important for Reserve ANC officers. The conclusions suggest that Operations Desert Shield/Storm had little direct impact on the future plans of these nurses; however, they did appear to highlight the possibility of other deployments that, in turn, had an impact on retention decisions.

TR 1027 Simulator sickness in virtual environments, Kolasinski, E.M. May 1995. (AD A295 861) Virtual Reality (also known as Virtual Environment or VE) technology shows many promising applications in areas of training, medicine, architecture, astronomy, data handling, teleoperation, and entertainment. A potential

threat to using this technology is the mild to severe discomfort that some users experience during or after a VE session. Similar effects have been observed with flight and driving simulators. The simulator sickness literature forms a solid background for the study of sickness in virtual environments and many of the findings may be directly applicable. This report reviews literature concerning simulator sickness, motion sickness, and virtual environments. Forty factors that may be associated with simulator sickness in virtual environments are identified. These factors form three global categories: subject, simulator, and task. The known and predicted effects of these factors on sickness in VEs are discussed. A table summarizes the information presented in this report. The information can be used as a guide for future research concerning simulator sickness in virtual environments.

TR 1028 Canceled.

TR 1029 The virtual environment performance assessment battery (VEPAB): Development and evaluation, Lampton, D.R.; Knerr, B.W.; Goldberg, S.L.; Bliss, J.P.; Moshell, J.M.; Blau, B.S. June 1995. (AD A297 277) The Virtual Environment Performance Assessment Battery (VEPAB) is a set of tasks developed to support research on training applications of VE (Virtual Environment) technology. VEPAB measures human performance on vision, locomotion, tracking, object manipulation, and reaction time tasks performed on three-dimensional, interactive VEs. It can be used to provide a general orientation for interacting in VEs and to determine entry-level performance and skill acquisition of users. In addition, VEPAB allows comparison of task performance, side effects and aftereffects, and subjective reactions across different VE

systems. By providing benchmarks of human performance, VEPAB can promote continuity in training research across different technologies, separate research facilities, and dissimilar subject populations. This report describes the development of VEPAB and summarizes the results of an experiment to test the sensitivity of the tasks to differences between input control devices and to examine practice effects.

TR 1030 Evidence for an interpersonal knowledge factor: The reliability and factor structure of tests of interpersonal knowledge and general cognitive ability, Legree, P.J.; Frafton, F.C. September 1995. (AD A299 659) Many aptitude scales measure general or academic knowledge and utilize a forced choice response format in which answers are scored as either correct or incorrect. In contrast to this traditional scoring procedure, quantifying performance on scales developed to measure interpersonal skills requires the opinions of multiple experts, and individual responses cannot be easily or unambiguously evaluated. Given this type of uncertain knowledge domain, a Likert procedure was modified to measure expertise based on the distance between expert and subject ratings of the relative strengths of a set of probabilistic relationships. In Phase 1, data were collected and indicate that an improvement in the reliability of an existing measure of leadership could be traditional forced choice format. In Phase 2, data were collected with the leadership scale and two additional interpersonal knowledge scales using Air Force recruits for whom Armed Services Vocational Aptitude Battery (ASVAB) data were available. Confirmatory factor analyses indicate that the factor structure of the 13-test battery (ASVAB plus the experimental scales) could be best ex-

plained by hypothesizing the existence of a separate interpersonal knowledge factor in addition to the four factors that are typically extracted from the ASVAB. These results demonstrate (1) the applicability of the Likert response format to efficiently measure individual differences in nontraditional knowledge domains such as interpersonal skills, and (2) the existence of a separate first-order factor that is labeled Interpersonal Knowledge.

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Abbreviations

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RP Research Product
RR Research Report

SN Study Note
SR Study Report
TR Technical Report

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